MANUAL OF METHODS IN FISHERIES BIOLOGY

compiled by

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Fascicule 8

Section 3. Observations on plankton, benthos, nekton and sea birds

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SECTION 3. OBSERVATIONS ON PLANKTON, BENTHOS, NEKTON AND SEA BIRDS

3.0 INTRODUCTION

This Section gives detailed directions on the collection of biological material other than the species of economic importance, which are dealt with in the next Section. It does not deal with the problems of planning field collection work which, in the case of plankton, may be of especial intricacy, but only with the manipulative operations of collection, handling and preservation. However the collection plan is of very considerable importance and should be adhered to as closely as possible. Each expedition plan should contain instructions not only as to places and times of collection, but also as to the modifications of this plan that should be introduced if and when necessary.

Plankton collection methods are of two principal kinds: those that take plankton from samples of water, and those that place collecting equipment in the sea and take samples of plankton from the open sea. The latter then fall into two classes: those that take single samples and those that make a continuous sampling over an extended traverse.

3.1 PLANKTON SAMPLING AND ANALYSES [to follow]

[At the time of going to press most of these methods are under active review by international working groups. The text of this subsection will therefore be issued later as a separate fascicule.]

3.2 OBSERVATIONS ON NEKTON IN GENERAL

In addition to the work on economic species, described in Section 4, other fish in the study area may have to be observed and collected. Collection is usually done with commercial fishing gear. Details of the gear used, location, depth of water and the time of fishing must be recorded. Special collecting gear is sometimes used, such as young fish trawls and large vertical plankton nets, for sampling fish larvae and megaloplankton.

Special experimental gear, which usually is miniature commercial fishing gear, is used from research vessels to catch pelagic animals.

Some nektonic animals which spend part of their life on or close to the bottom (e.g., during daytime) are caught with beam and high-speed dredges.

Observations on the appearance of nekton should be made besides direct collecting; for example, fish shoals, flying fish, mammals, the behavior of the shoal, etc. seen, should be noted in the log.

All observations on pleuston such as on floating logs, floating seaweeds, the discoloration of the sea, etc., should also be carried into the log.

Most of the work on nekton is carried out by methods similar to those used for commercially important species as described in Section 4.

3.3 BENTHOS SAMPLING AND ANALYSES

3.3.1 **Sampling of benthos**

The qualitative study of benthos is usually conducted with various dredges, such as the regular beam dredge, the scoop, the anchor, and the high-speed dredge for catching fast-moving animals on the bottom, bottom plankton net, etc.

When dredging care should be taken that enough cable is paid out (at least three times the depth of the water) and that the dredging speed is not too high, to ensure that the dredge is towed along the bottom. In shallower water the vibration of the cable will tell whether the dredge is on the bottom or not.

Considerable skill is needed when dredging on rough bottoms and the rigging of gear for rough bottoms differs from that for good bottoms. It is often advisable to arrange a "weak spot" close to the dredge so that if it catches immovably on a rock, the gear is detached and perhaps lost, but no damage is done to the cable or winch.

Attempts have been made to mount counting wheels on the dredges for determination of the length of haul. These counting wheels function satisfactorily only if the dredging speed is slow, the dredge relatively heavy and the bottom consists of consolidated material. In most cases however, dredges jump considerably on the bottom and/or dig occasionally into soft material and incapacitate the counter wheel so that the estimation of the length of haul becomes questionable.

Submarine photography and television have been used on a few occasions for investigations of epifauna. Although these instruments give a picture of the nature of sediment surface and the population of macroepifauna on it, they are not useful for quantitative benthos work for fisheries purposes, because the infauna on the surface layer is usually the most important benthos fish food.

Various grabs are used for quantitative studies of benthos the most common being Petersen and Van Veen grabs, which have a working area of 0.1 or 0.2 m^2. The spring-loaded grab is among the more expensive and complicated devices for this work. The various grabs usually have different working capacities according to the kinds of bottom, and a volume correction can be applied for greater precision.

The bottom sample upon arrival on board is washed through a set of sieves (usually with 2-, 1-, 0.5- and 0.2-cm mesh openings) after a small (about 50 g

wet weight) composite sample of the bottom substrata is taken for sediment study. The animals are carefully collected from the screens and preserved in 60% alcohol or in 4% formaldehyde. The containers are labeled with the following data: date, position (station number), depth of water, the area of grab, the volume of sample, name of the collector, and special information such as the environmental data T.S., the type of sediment etc.

For a preliminary benthos survey on a limited fishing ground, 20 - 70 bottom samples give an approximate picture of the quantitative and qualitative distribution of benthos. It is very helpful, when experimental trawling is carried out in unknown waters, especially in tropical and subtropical areas, if a number of benthos samples are collected at the same time.

3.3.2 **Aquatic vegetation analysis**

Vegetation beds should be plotted on the map of the lake, using standard symbols for the types of vegetation found. These symbols are:

⁻ for floating vegetation
| for emergent vegetation
— for submergent vegetation

Vegetation stations should be numerous enough to give a good cross section of the plants in the lake or stream. The exact number will have to be determined by the technician making the analysis, according to his best judgment.

In lakes, a vegetation station 10 meters by 10 meters is suggested. In streams, 3-meter strips should be adequate.

For each species of aquatic plants found, enter on the record form the information called for.

Depth range. Give range in depth in which plant is found, i.e., 0.5 to 3 meters.

Relative abundance. Use symbols as follows:

S Sparse, if only scattered plants are found

M Medium, if spaced 0.5 to 3 meters apart

D Dense, if closer together than 0.5 meters, or forming a closed mass

Remarks. Note whether plants are marl covered by placing a C in this column on the record form. Note also flowering, fruiting or budding of plants, using symbols: Fl - flowering; Fr - fruiting; and B - budding or winter buds.

If identification cannot be made in the field, specimens should be preserved for later study. The following procedure for collecting plants is recommended.

1. Select an average plant.

Form 1. - Bottom food analysis log

Lake or Stream ..... Date .....

Depth ..... Area of bottom sampled .....

Type of dredge ..... Type of bottom .....

Vegetation ..... Volume of sample cc

Organisms in sample	Numbers

Determined by: .....

Form 2. - Aquatic vegetation record

Lake or Stream ..... Date .....

Species	Depth range	Relative abundance	Remarks
.....		.....	
.....		.....	
.....		.....	
.....		.....	
.....		.....	
.....		.....	
.....		.....	
.....		.....	
.....		.....	
.....		.....	
.....		.....	
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.....		.....	
.....		.....	

2. When possible, collect a plant which has both flowers and fruit, but take in vegetative condition if you cannot obtain it otherwise. Usually July, August and early September are the best months for obtaining specimens in the north temperate zone.
3. When possible, collect a part of the underground portions along with the top.
4. A large plant can be cut up and selected for preserving, or may be preserved in several folders, labeling each portion in order: *a*, *b*, *c*, *d*, etc. If portions are preserved, be sure to put on label the total length or height of the plant and other pertinent information.
5. Place plant between folded sheets of newspaper.
6. Fill out label with all data and place with specimens. The collection number should be written on edge of newspaper in case label falls out, so that it may be placed with proper specimen.
7. Place folded newspaper between blotters and place in press. Draw pressboards down tight.
8. After collections have been under pressure 4 to 6 hours, or overnight, replace wet blotters with dry ones and insert corrugated ventilators between blotter (blotter, folder, blotter, ventilator, blotter, etc.). If specimens were very wet it may be necessary to replace blotters again the second day.

3.3.3 Laboratory analysis of benthos samples

The laboratory analysis of benthos collection consists usually of determination of the quantities, species composition and the percentage of different classes of fish food in the benthos. The taxonomic grouping of the sample should be done before the quantitative measurement. Often it is necessary to group the sample not only taxonomically, but also by the fish food groups and by the preferences of the species for food, according to the experience gained from earlier stomach analysis.

For determination of the organic matter in the benthos, the alcohol weights of the preserved materials are determined or, in the case of small quantities, the volumes measured by displacement in graduated cylinders, after which the calcareous shells are separated and the weight determined. These weights are subtracted from the total weights of the corresponding groups determined earlier.

3.3.4 Explanation of terms

BENTHOS. Animals (and plants) living in the bottom substrata (in the water).

BIOMASS. The live weight of animals or plants.

BIOTA. The flora and fauna of a region.

HABITAT. The natural abode of a plant or animal, especially the particular location where it normally grows or lives.

3.3.5 References

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3.4 OBSERVATIONS ON AQUATIC BIRDS

The recording of the abundance and behavior of oceanic birds is very important for exploratory fishing and the location of fishing grounds. The following observations should be recorded:

1. The location and time.
2. Time of the observations.
3. The species of bird.
4. Their abundance.
5. Direction of movement.
6. Flocks or single, and the kind and size of the flocks.
7. Floating or flying.
8. Other behavior (e.g., feeding on fish, diving activities, etc.).

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